



JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING



STEVEN E. CHESTER
DIRECTOR

August 17, 2006

Mr. Juan Thomas
U.S. Environmental Protection Agency, Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3507

Dear Mr. Thomas:

Subject: Final Determination of a Mixing Zone Request; BASF (North Works);
MID 064 197 742

The Michigan Department of Environmental Quality (MDEQ), Waste and Hazardous Materials Division (WHMD), has reviewed BASF's request for a Mixing Zone Determination for venting groundwater to the Detroit River from the BASF (North Works) facility, in Wayne County and forwarded that request to the MDEQ, Water Bureau (WB). The WB responded to that request for a mixing zone determination and a copy is attached to this letter. The response WB provided identifies the acceptable concentration limits for discharge of the various chemicals characterized in BASF's mixing zone request to the Detroit River.

Based on the information WB provided, it is determined that there is a reasonable potential for the discharge of some chemicals to cause or contribute to water quality standards (WQS) being exceeded.

Recommended mixing zone-based groundwater surface water interface (GSI) values are summarized in the tables below:

Table 1: Groundwater Venting from the Upper Fill Unit

Parameter	Final Acute Value (ug/L)	Chronic Value (ug/L)	Reported Worst Case Maximum Site Concentration (ug/L)
Mercury	n/a	0.0013	3.9
Phenol	6800	n/a	1100
Vanadium	220	n/a	42

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Table 2: Groundwater Venting from the Lower Sand Unit

Parameter	Final Acute Value (ug/L)	Chronic Value (ug/L)	Reported Worst Case Maximum Site Concentration (ug/L)
Aldrin	0.30	n/a	0.05
Total PCB	n/a	0.000026	1
Arsenic	680	n/a	190
Barium	2500	n/a	1100
Benzene	1900	n/a	2300
Cadmium	18	n/a	4.3
Chlorobenzene	850	n/a	640
Copper	40	n/a	420
Ethylbenzene	320	n/a	53
Lead	830	n/a	220
Mercury	n/a	0.0013	0.033
Vanadium	220	n/a	500
Zinc	490	n/a	600

General Comments

1. The final acute values listed above are the acute mixing zone-based GSI criteria. These limits are provided for chemicals determined to have a reasonable potential to exceed the acute mixing zone-based GSI criteria. These values (as well as the generic GSI criteria for other chemicals not specifically identified in the mixing zone request) must not be exceeded at the GSI compliance monitoring wells; if they are, further remedial action will be required. BASF has the following options in regards to parameters that exceed the acute mixing zone-based GSI criteria in site monitoring wells:
 - a. If exceedances are upgradient of the compliance monitoring wells, BASF must demonstrate that data from a final approved GSI compliance monitoring well system are, and will be, in compliance with acute mixing zone-based GSI criteria for those parameters. Averaging of groundwater data is not allowed for comparison to generic GSI or acute mixing zone-based GSI criteria, nor is it allowed for bioaccumulative contaminants of concern (BCCs). Acute mixing zone-based or generic GSI criteria may not be exceeded in any individual GSI compliance monitoring well.
 - b. The effluent limits for Aldrin, Barium, Benzene, Chlorobenzene, Ethylbenzene, Phenol, and Vanadium are based upon Tier II water quality values. BASF does have the option to submit additional aquatic toxicity testing data that may allow for the development of less restrictive criteria (Tier I) for these parameters. See Attachment 1 of the attached WB memorandum. BASF should contact the WB for guidance prior to conducting any additional testing.

- c. Prevent the discharge of all parameters that exceed the acute mixing zone-based GSI criteria in the GSI compliance monitoring wells. This option would require the focus of subsequent site investigations to hydrogeologically define remediation designs for capturing the groundwater discharge, further plume characterization, and identification of sources for source control measures.
2. The chronic values listed above are the chronic mixing zone-based GSI criteria. Chronic limits are provided for chemicals determined to have a reasonable potential to exceed WQS. Chronic mixing zone-based criteria were provided for Mercury venting to the Upper Fill Unit and for total PCBs and Mercury venting to the Lower Sand Unit. The facility must demonstrate that data from GSI compliance monitoring wells are in compliance with the chronic (as well as the acute) mixing zone-based GSI criteria. Statistical techniques are usually appropriate for judging compliance with chronic mixing zone-based GSI criteria. However, since the two parameters that have chronic mixing zone based GSI criteria are BCCs, statistical analyses will not be permissible. Additional details can be found in "Statistical Guidesheet #3" of the DEQ document titled *Sampling Strategies and Statistics Training Materials for Part 201 Cleanup Criteria*.
3. It has been determined that any other parameter not given a recommended mixing zone-based GSI criteria in one of the tables above, or in the attached memorandum, will not cause or contribute to WQS being exceeded at this time. This determination is based upon the reported maximum values in BASF's mixing zone request which was submitted to the WB by the WHMD.
4. The sampling procedures, preservation and handling, and analytical protocol for compliance monitoring for total PCBs shall be in accordance with U.S. Environmental Protection Agency (U.S. EPA) Method 608. Total PCBs shall be defined as the sum of the following aroclors: 1016, 1221, 1232, 1242, 1248, 1254, and 1260. There is a dependable detection limit of 0.2 ug/l set for total PCBs. Therefore, the mixing zone-based GSI criteria for total PCBs will be set at 0.2 ug/l. Any concentration determined below this 0.2 ug/l limit will be treated as zero in the calculation of the total PCBs for that well. Any concentration at 0.2 ug/l or higher will be included in the total PCBs for that well. All individual concentrations must be reported in the monitoring reports submitted to the U.S. EPA and/or MDEQ (whether above or below 0.2 ug/l), but only those concentrations at 0.2 ug/l or higher will be included in the calculation of the total PCBs for that well. Please see Attachment 2 of the attached memorandum from the WB for additional details.

In order to demonstrate long-term compliance with the mixing zone-based GSI criteria, BASF will need to submit a Mixing Zone Compliance Monitoring Plan, for review and approval. The Mixing Zone Compliance Monitoring Plan should include a Sampling and Analysis Plan (to address both mixing zone chemicals and other chemicals reported in the mixing zone request), identification of the wells that BASF proposes to sample to show compliance with the mixing zone-based GSI criteria (both along the GSI and within the appropriate portions of the plume), and provide an explanation of the

monitoring schedule and reporting process. BASF should submit the Mixing Zone Compliance Monitoring Plan to the U.S. EPA, within 60 days of receipt of their GSI limits.

In addition to the specific Mixing Zone Compliance Monitoring Program, if any GSI compliance monitoring data show exceedances of the maximum value reported to the WB in the mixing zone determination request (i.e., for chemicals submitted in the mixing zone request but were shown to not be a concern at this time), the data must be promptly evaluated by BASF to determine the significance and whether a new mixing zone determination request should be submitted to the WB. If there is an exceedance of the prior reported maximum value for any parameter of concern, BASF should contact the U.S. EPA for further direction.

Should you have any questions regarding this letter or the Mixing Zone Determination, please contact me at slaytond@michigan.gov or by telephone.

Sincerely,

/S/

David Slayton, Geologist
Hazardous Waste Technical Support Unit
Hazardous Waste Section
Waste and Hazardous Materials Division
517-373-8012

Attachment:

cc: Mr. Lawrence Aubuchon, DEQ – SE Michigan District
Mr. Stephen Buda - DEQ
Mr. Ron Stone/Mr. John McCabe/Mr. David Slayton/Reporting
CA File

Ron Stone
CA file
742

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Liane J. Shekter Smith, P.E., Assistant Division Chief, Waste and Hazardous Material Division

FROM: Michael Alexander, Surface Water Assessment Section, Water Bureau *For Mike Alexander*

DATE: August 2, 2006

SUBJECT: Mixing Zone Determination Request, BASF (North Works); MID 064 197 742

We have reviewed the data associated with a request for mixing zone determination for two groundwater plumes in Wayne County, located at the BASF North Works facility. The Upper Fill unit and the Lower Sand Unit groundwater plumes are venting at a rate of 0.003 cubic feet per second (cfs) and 0.00053 cfs respectively to the Detroit River. The Detroit River has a 95% exceedance flow, harmonic mean flow, and a 90dQ10 flow of 29,200, 47,000, and 41,630 cfs, respectively.

The sources of information used for this review include the mixing zone determination request and flows from the Detroit River in the vicinity of the groundwater venting.

The review of the venting of these chemicals was conducted according to Rule 323.1211 of the Part 8 Rules, Water Quality-Based Effluent Limit Development For Toxic Substances. Based upon the above information we have the following recommendations:

Upper Fill Unit:

Mercury, phenol, and vanadium have the reasonable potential to exceed acute and/or chronic water quality standards (Table 1). Please note that the water quality standards for phenol and vanadium are based on Tier II criteria. The responsible party(s) are at liberty to provide additional toxicity data to develop Tier I criteria if they so choose (Attachment 1).

Table 1. The concentration of the pollutant(s) at the groundwater surface water interface (GSI) are data provided from the mixing zone request memo while the potential effluent quality (PEQ) at the GSI is based on the appropriate reasonable potential multiplier for one datum (6.2). The Final Acute Value (FAV) and Final Chronic Value (FCV) limits are those values which, if exceeded, will result in a violation of surface WQS at the GSI (FAV) or within the mixing zone of the receiving stream (FCV).

Chemical Parameter	Concentration at the GSI (ug/L)	PEQ at the GSI (ug/L)	Acute limit (FAV) (ug/L)	Chronic Limit (FCV) (ug/L)
Mercury	3.9	24	2.8	0.0013
Phenol	1100	6820	6800	-
Vanadium	42	260	220	-

Waste & Hazardous
Materials Division

AUG 04 2006

Lower Sand Unit:

Aldrin, polychlorinated biphenyl (PCB), arsenic, barium, benzene, cadmium, chlorobenzene, copper, ethylbenzene, lead, mercury, vanadium, and zinc have the reasonable potential to exceed acute and/or chronic water quality standards (Table 2). Please note that the water quality standards for aldrin, barium, benzene, chlorobenzene, ethylbenzene, and vanadium are based on Tier II criteria. The responsible party(s) are at liberty to provide additional toxicity data to develop Tier I criteria if they so choose (Attachment 1). The final chronic value for total PCB is less than the current quantification level for EPA approved methods. Therefore, compliance with the chronic value shall be determined as described in attachment 2.

Table 2. The concentration of the pollutant(s) at the groundwater surface water interface (GSI) are data provided from the mixing zone request memo while the potential effluent quality (PEQ) at the GSI is based on the appropriate reasonable potential multiplier for one datum (6.2). The Final Acute Value (FAV) and Final Chronic Value (FCV) limits are those values which, if exceeded, will result in a violation of surface WQS at the GSI (FAV) or within the mixing zone of the receiving stream (FCV).

Chemical Parameter	Concentration at the GSI (ug/L)	PEQ at the GSI (ug/L)	Acute limit (FAV) (ug/L)	Chronic Limit (FCV) (ug/L)
Aldrin	0.05	0.31	0.30	-
Total PCB	1	6.2	-	0.000026
Arsenic	190	1178	680	-
Barium	1100	6820	2500	-
Benzene	2300	14260	1900	-
Cadmium	4.3	27	18	-
Chlorobenzene	640	3968	850	-
Copper	420	2604	40	-
Ethylbenzene	53	329	320	-
Lead	220	1364	830	-
Mercury	0.033	0.21	-	0.0013
Vanadium	500	3100	220	-
Zinc	600	3720	490	-

Total cyanide was detected in both the Upper Fill and Lower Sand Units. The water quality standard for cyanide is expressed as available cyanide. To evaluate compliance with the cyanide standard the responsible party(s) will need to analyze both units with the EPA approved method OIA-1677. The maximum concentration for total cyanide at the GSI was 1,800 micrograms per liter (ug/L) and 46,000 ug/L at the Upper Fill and Lower Sand Units respectively. The acute limit (FAV) for available cyanide is 44 ug/L.

Please feel free to contact me if you have comments or questions regarding this memo.

ma:rm

Attachments

cc: David Slayton, WHMD

Eric Alexander/Venting Groundwater File, WD

Attachment 1

Option to Provide Additional Toxicity Data (NOTE, THIS MUST BE INCLUDED WHENEVER A TIER II VALUE IS USED FOR A LIMIT IN THE PERMIT, A SCHEDULE OF COMPLIANCE MUST BE ESTABLISHED FOR THE LIMIT AND MUST ALLOW FOR PERMIT MODIFICATION AS ESTABLISHED BELOW)

The effluent limits for _____ See List Below _____ (LIST CHEMICALS) are based upon Tier II water quality values. On or before _____ (DATE 2 YEARS FROM DATE OF ISSUANCE), the permittee may submit additional mammalian or aquatic toxicity data to reduce the uncertainty factor used in the development of Tier II values or to allow for calculation of Tier I values. Prior to conducting any additional toxicity testing, the permittee should contact the DISTRICTNAME District Supervisor to determine the appropriate testing. Following submittal and review of this data, this permit may be modified in accordance with applicable laws and rules.

aldrin, barium, benzene, chlorobenzene, ethylbenzene, phenol, and vanadium

Limits below the Quantification Level

The sampling procedures, preservation and handling, and analytical protocol for compliance monitoring for Total PCB shall be in accordance with EPA Method 608. The quantification level shall be 0.2 ug/L unless a higher level is appropriate because of sample matrix interference. Justification for higher quantification levels shall be submitted to the Department within 30 days of such determination.

The water quality-based effluent limitations for Total PCB are less than the quantification level; therefore, control requirements are established consistent with R 323 1213. Any discharge of **Error! Reference source not found.** at or above the quantification level specified in this permit is a specific violation of water quality standards. For the purpose of determining if a venting groundwater sample is less than the quantification level, Total PCBs shall be defined as the sum of the individual analytical results for each of the aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260 with any aroclor result less than the quantification level being treated as a zero. For the purpose of reporting, the potentially responsible party shall calculate concentration and loading levels of Total PCBs in this same manner; however, the result of any individual aroclor measurement less than the quantification level but greater than the detection level shall be reported on the Monitoring Reports. This paragraph does not authorize the discharge of Total PCB at levels which are injurious to the designated uses of the waters of the state or which constitute a threat to the public health or welfare.

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Liane J. Shekter Smith, P.E., Assistant Division Chief, Waste and Hazardous
Material Division

FROM: Michael Alexander, Surface Water Assessment Section, Water Bureau
Eric Reynolds for Mike Alexander

DATE: August 2, 2006

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DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

nterim Final 2/5/99

RCRA Corrective Action Environmental Indicator (EI) RCRIS code (CA750)

Migration of Contaminated Groundwater Under Control

Facility Name: BASF Inc. (North Works Facility)
Facility Address: 1609 Biddle Ave., Wyandotte, MI 48192
Facility EPA ID #: MID 064 197 742

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

X If yes - check here and continue with #2 below.
— If no - re-evaluate existing data, or
— if data are not available skip to #6 and enter "IN" (more information needed) status
code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains **ONLY** to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database **ONLY** as long as they remain

Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA750)

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2. Is **groundwater** known or reasonably suspected to be "**contaminated**"¹ above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

 X

If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Groundwater is known to be contaminated above the National Primary Drinking Water Regulations Maximum Contaminant Levels and the applicable sections of the Michigan Act 451, Part 201 generic cleanup criteria for groundwater. The applicable Michigan Act 451, Part 201 generic cleanup criteria for groundwater include Groundwater Contact Criteria, and the Groundwater/Surface Water Interface Criteria. There are no present users of on-site groundwater and groundwater usage is prohibited as a potable source. In fact, on-site groundwater is not used as a source of drinking water in the city of Detroit and the nearby suburbs such as Wyandotte. The City of Wyandotte, Michigan Plumbing Code state in Article 3, Section P-303, "the water distribution system of any building in which plumbing fixtures are installed shall be connected to a public water main and sewer system, respectively". Hence the contaminated groundwater on-site is prohibited from potable usage by restrictive covenant. Tap water comes from Lake St. Clair and the Detroit River. The February 1999 Phase I Remedial Investigation Report (RFI Report), the March 2000 Corrective Measures Study Field Program Report (CMS Field Report), and the September 2004, CMS Supplemental Groundwater Sampling Results Report all indicate that the BASF Corporation Wyandotte, Michigan facility has had site-wide groundwater contamination. The 230 acre facility has had industrial operations taking place on-site for over one hundred years. Typical operations of the plant changed in around 1980 where the corporation transitioned from the manufacturing of inorganic bulk commodities, to specialty plastics, resins and pharmaceutical products. Historically, groundwater contamination on-site have included metals, pesticides, and various volatile and semi-volatile organic compounds.

The table below highlights contaminants in groundwater that exceeded the Michigan Act 451, Part 201 generic Groundwater/Surface Water Interface Criteria:

¹ "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA750)

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Well	Constituent	Max. Conc. ug/L	GSI Criteria ug/L	Well	Constituent	Max. Conc. ug/L	GSI Criteria ug/L
RFIMW-01 native	1,4-Dioxane	120	34	RFIMW-09 native	Chromium	88	11
	Mercury	0.028	0.0013		Mercury	0.00137	0.0013
	thallium	7.65	1.2		thallium	9.4	3.7
	total CN	53	5.2		Arochlor 1254	1	0.2
RFIMW-08 native				RFIMW- native	Aldrin	0.05	0.01
	Barium	1100	440		Antimony	8.5	2
	Chromium	32	11		Arsenic	140	150
	Copper	33	9		Cadmium	4.3	2.2
	Mercury	0.0053	0.0013		Copper	420	9
	total CN	10	5.2		Lead	220	10
RFIMW-12 fill unit	Zinc	240	120		Mercury	0.0016	0.0013
	Chromium	19	11	CMSMW- fill unit	Nickel	130	52
	Mercury	0.0014	0.0013		total CN	52	5.2
	phenol	1100	210		Vanadium	79	12
	thallium	5.9	1.2		Zinc	600	120
	total CN	1800	5.2		Mercury	0.434	0.0013
RFIMW-22 native sand	Vanadium	42	12		methane	16000	NA
	1,4-Dioxane	87	34	CMSMW-8 fill unit	Mercury	3.9	0.0013
	Arsenic	190	50				
	benzene	2300	12				
	chlorobenzen e	640	47				
	Chromium	61	11				
	Copper	17	9				
	ethylbenzene	53	18				
	Mercury	0.0333	0.0013				
	total CN	46000	5.2				
	Vanadium	500	12				

**Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA750)**

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vinyl chloride 280 15

References:

ENSR International, CMS Supplemental Groundwater Sampling Results, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 September 2004

ENSR International, Risk Screening Summary Report, for the BASF North Works Facility, Wyandotte, Michigan,
April 2005

Parsons Engineering Science, Inc., 1998. Update of 1994 RCRA Facility Investigation Report of Current Conditions

Parsons Engineering Science, Inc., RCRA Corrective Measures Study, Field Program Report, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 March 2000

QST Environmental Science (formerly Environmental Science & Engineering, Inc.), Phase I RCRA Facility Investigation Report for BASF-Wyandotte Facility, 26 February 1999

Waterloo Hydrogeologic, Inc., BASF Wyandotte North Works Corrective Measures Study Groundwater Modeling, Conceptual Hydrogeologic Model & Model Calibration Report

Woodward-Clyde Consultants, 1994. RCRA Facility Investigation Report of Current Conditions.

Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA750)

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3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"² as defined by the monitoring locations designated at the time of this determination)?

X

If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"².

If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"²) - skip to #8 and enter "NO" status code, after providing an explanation.

If unknown - skip to #8 and enter "IN" status code.

 Rationale and Reference(s):

The migration of contaminated groundwater has stabilized and is expected to remain within the existing area of contaminated groundwater. Five stratigraphic units can be described beneath the site. These five units were classified in descending order as the 1) fill unit, 2) clay and peat unit, 3) native sand unit, 4) lacustrine clay unit and 5) bedrock unit. The surface strata are comprised of industrial fill (up to 25ft in thickness). Fill materials (primarily industrial residues generated on-site) were deposited on-site to fill in marshland areas and raise the entire site to its present grade. This fill varied in nature from alkaline lime waste, including distiller blow-off (DBO), to acidic fly ash and cinders. The fill also includes some deposits of relatively clean sand and clay, metal, wood and masonry debris. In most instances, the transition from marshland to fill is sharply defined due to borehole evidence of the original vegetation from the marshland bottoms. In general, the fill rests on peat or organic clays that evolved from the original marsh bottom deposits. Where present, the peat material occurs approximately 5 to 10 ft. below land surface (bls) and ranges up to 13 ft in thickness depending on location, though 2 to 3ft is typical. The layers below the peat (or below the fill where the peat is absent) consist of sands with discontinuous pockets of clay. Sand is prevalent beneath the western portion of the site, but pinches out to clay to the east in parts of the site. The glacial lacustrine clay underlies this sand.

Hydrostratigraphic cross-sections, potentiometric surface maps, and groundwater quality data were used to assess groundwater flow and transport conditions and potential groundwater contaminant

² "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

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migration/stabilization to the Trenton Channel/Detroit River located east of the site. The site has a long seawall that separates the fill from the river (Trenton Channel). There are two forms of construction used. The original seawall measures approximately 4700 ft in length and runs from the northeast corner of the site to a point approximately 850 ft from the southeast corner of the site. It is constructed of double layer of 3 inch thick, overlapping timbers. The remaining 850 ft of shoreline to the south is treated with rip-rap stones. A second seawall, consisting of sheet pilings approximately 40 ft deep runs parallel to the first wall for a distance of approximately 3360 ft from the northeast corner of the site. The steel seawall is keyed into the underlying lacustrine clay, and is separated from the original seawall by approximately 2 ft. The joints between steel pilings are not sealed. The seawall has three zones, in terms of resistance to flow, as shown in the table 2 below.

Table 2. Seawall Zones

Construction	Length	Resistance to Horizontal Flow
oak timbers and steel pilings	3360 ft	medium to high
oak timbers only	1340 ft	low
rip-rap	850 ft	none

Groundwater discharge from the BASF Corporation North Works facility is expected to be small because of the combined effects of the natural hydraulic isolation of the site, the groundwater extraction system, (a total of 15 groundwater extraction wells are installed in the south-central portion of the site), and the oak and steel retaining wall erected along the Trenton Channel/Detroit River riverbank. It has been reported that small quantities of water may leave the site by diffuse flow of the Detroit River along portions of the waterfront that does not have a steel retaining wall and by flow patterns across the northern boundary of the site. ***An evaluation of the groundwater extraction system as reported in the 1999 Phase I RFI Report concluded that: The extraction system appears to be most effective in the southern half of the facility where a majority of the horizontal hydraulic gradients are essentially flat or slightly toward the interior of the facility. In contrast, horizontal gradients towards the river along the northern portion of the facility indicate a reasonable potential for off-site migration in these areas. The presence of a groundwater "divide" is indicated roughly parallel to the river along the eastern side of the facility. Although its location cannot be precisely defined at this time, this divide supports the conclusion that a component of groundwater is likely discharging to the river.***

Groundwater contour maps have been constructed for both the fill and native sand units. Pumping test illustrated that the fill unit and native sand unit are hydraulically disconnected. The flow direction of the groundwater in the fill material shows the groundwater flowing in a general easterly direction toward the Trenton Channel/Detroit River. Potentiometric surface maps of the fill unit illustrated that groundwater is flowing in a north-easterly direction in the northern one third of the facility, and in the remainder of the facility there is a southerly component of groundwater flow direction. There is apparent groundwater divide running approximately through monitoring wells CMSMW-16 and RFIMW-5 and could be attributed to the presence of DBO (Distiller Blow-off), material present south and east of these two wells. The pattern of the contour lines in the vicinity of these two wells most likely indicate the flow of groundwater around the DBO fill material which is known to have a relatively low permeability. Potentiometric surface maps of the sand unit illustrate that groundwater flow in the native sand unit closely mimics the groundwater flow in the fill unit, although for different reasons. The peat layer that separates the native sand unit and the fill unit is not continuous across the western portion of the north end of the facility. The absence of the clay unit allows the native sand unit and the fill unit to be in better hydraulic communication with each other; hence the similarity of groundwater flow conditions. In the native sand units, the groundwater flow south of the

**Migration of Contaminated Groundwater Under Control
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apparent divide in the vicinity of monitoring well CMSMW-5 and RFIMW-6, is towards the south. This flow pattern is attributable to two separate subsurface characteristics: the groundwater extraction system operating in the south-central area of the facility, where the groundwater along the southern edge of the facility is shown to be flowing north towards the extraction system. This indicates that in the native sand unit, the existing groundwater extraction system is preventing groundwater from leaving the site at the southern edge. Additionally groundwater contour maps of the native sand unit illustrate a truncation of the groundwater contour lines in the eastern portion of the facility and this is attributed to the native sand unit pinching out along the western edge of the clay ridge and the presence of the overlying peat unit. As noted during performance of pump testing, the fill unit and the native sand unit are hydraulically disconnected. The isolation of the native sand unit from the fill material coupled with the groundwater surface elevations measured in the native sand wells indicate that the native sand unit is at a minimum, semi-confined and groundwater is under some pressure. Although the groundwater elevations measured in the wells screened in the native sand unit are above the elevation of the clay ridge, the overlying peat unit serves as the upper boundary for the groundwater surface. The peat layer covers the native sand unit and the western leg of the clay ridge and prevents (or greatly limits) groundwater in the native sand unit from flowing west, over the clay ridge and into the Trenton Channel/Detroit River.

References:

ENSR International, CMS Supplemental Groundwater Sampling Results, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 September 2004

ENSR International, Risk Screening Summary Report, for the BASF North Works Facility, Wyandotte, Michigan, April 2005

Parsons Engineering Science, Inc., 1998. Update of 1994 RCRA Facility Investigation Report of Current Conditions

Parsons Engineering Science, Inc., RCRA Corrective Measures Study, Field Program Report, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 March 2000

QST Environmental Science (formerly Environmental Science & Engineering, Inc.), Phase I RCRA Facility Investigation Report for BASF-Wyandotte Facility, 26 February 1999

Waterloo Hydrogeologic, Inc., BASF Wyandotte North Works Corrective Measures Study Groundwater Modeling, Conceptual Hydrogeologic Model & Model Calibration Report

Woodward-Clyde Consultants, 1994. RCRA Facility Investigation Report of Current Conditions.

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4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

 X

If yes - continue after identifying potentially affected surface water bodies.

If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

If unknown - skip to #8 and enter "IN" status code.

 Rationale and Reference(s):

The presence of a seawall constructed of 3360 ft of oak timbers and steel pilings keyed into the lacustrine clay layer, and 1340 ft of oak timbers only, a groundwater pump and treat system consisting of 15 groundwater extraction wells installed in the south-central portion of the facility and the presence of a clay ridge that pinches out from the southeast portion of the facility that extends and cuts across northeasterly to the approximate central portion of the facility, all combined to serve to retard the flow of off-site groundwater migration to the Trenton Channel. The absence of a retaining wall/seawall on the southeast perimeter of the facility for approximately 850 ft and the permeability of the fill unit (geometric mean hydraulic conductivity (K) value of 6.62 ft/day) and of the native sand unit (geometric mean hydraulic conductivity (K) value of 2.53 ft/day), as well as an analysis of potentiometric surface maps of both the fill and native sand units illustrate that there is some discharge of groundwater to the Trenton Channel/Detroit River.

References:

ENSR International, CMS Supplemental Groundwater Sampling Results, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 September 2004

ENSR International, Risk Screening Summary Report, for the BASF North Works Facility, Wyandotte, Michigan, April 2005

Parsons Engineering Science, Inc., 1998. Update of 1994 RCRA Facility Investigation Report of Current Conditions

Parsons Engineering Science, Inc., RCRA Corrective Measures Study, Field Program Report, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 March 2000

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QST Environmental Science (formerly Environmental Science & Engineering, Inc.), Phase I RCRA Facility Investigation Report for BASF-Wyandotte Facility, 26 February 1999

Waterloo Hydrogeologic, Inc., BASF Wyandotte North Works Corrective Measures Study Groundwater Modeling, Conceptual Hydrogeologic Model & Model Calibration Report

Woodward-Clyde Consultants, 1994. RCRA Facility Investigation Report of Current Conditions.

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5. Is the **discharge** of "contaminated" groundwater into surface water likely to be "**insignificant**" (i.e., the maximum concentration³ of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

_____ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration³ of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

X

If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration³ of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations³ greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown - enter "IN" status code in #8.

_____ **Rationale and Reference(s):**

Approximately 31 groundwater monitoring wells are installed along the northern, eastern, and southern perimeter of the BASF North Works Facility. These wells are installed in either the fill unit aquifer or sand unit aquifer and are all located in close proximity to the Trenton Channel/Detroit River. Both, historical and more recent groundwater sampling analysis have detected constituents that exceeded the applicable Michigan Act 451, Part 201 generic cleanup criteria for groundwater include that included Groundwater Contact Criteria, and the Groundwater/Surface Water Interface Criteria. We assumed that the discharge of contaminated groundwater is potentially significant.

³ As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

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References:

ENSR International, CMS Supplemental Groundwater Sampling Results, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 September 2004

ENSR International, Risk Screening Summary Report, for the BASF North Works Facility, Wyandotte, Michigan, April 2005

Parsons Engineering Science, Inc., 1998. Update of 1994 RCRA Facility Investigation Report of Current Conditions

Parsons Engineering Science, Inc., RCRA Corrective Measures Study, Field Program Report, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 March 2000

QST Environmental Science (formerly Environmental Science & Engineering, Inc.), Phase I RCRA Facility Investigation Report for BASF-Wyandotte Facility, 26 February 1999

Waterloo Hydrogeologic, Inc., BASF Wyandotte North Works Corrective Measures Study Groundwater Modeling, Conceptual Hydrogeologic Model & Model Calibration Report

Woodward-Clyde Consultants, 1994. RCRA Facility Investigation Report of Current Conditions.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented⁴)?

X

If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR

⁴ Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

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2) providing or referencing an interim-assessment,⁵ appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

____ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

____ If unknown - skip to 8 and enter "IN" status code.

____ **Rationale and Reference(s):**

A Groundwater-surface water mixing zone determination was computed for four constituent of concern whose concentrations in groundwater were determined to be "significant" based on the constituents' concentrations exceeding the Michigan Act 451, Part 201 Groundwater/Surface Water Interface Criteria as indicated in question #5. These constituent concentrations were taken from perimeter well locations primarily from the eastern side of the facility in front of the seawall or rip-rap barrier wall constructed along the facility fill and Trenton Channel interface. Well locations RFIMW-22 and CMSMW-2 are located along the northern perimeter of the facility. The constituents are mercury, cyanide, aldrin and arochlor 1254 (PCB). Since mercury represents the worst-case site specific constituent (in the fill unit) having probability for groundwater-surface water discharge, mercury in groundwater at monitoring well CMSMW-8 will be evaluated for its acceptability in discharging into the Trenton Channel/Detroit River. Based on the mercury concentration calculated in the mixing zone model, the resulting calculated mixing zone concentration i.e., groundwater to surface water discharge, will be compared to the appropriate surface water protection criteria.

Areas of Groundwater Discharge Associated With Current Exceedences in the Groundwater fill unit

The discharge area is being computed from a horizontal distance of 2200 ft which is the width of the interface of the most likely groundwater migration pathway into the Trenton Channel. This width represents the absence of the steel retaining wall constructed along the Trenton Channel Riverbank. The height of the interface is 12 ft as taken from geological cross-section maps. Groundwater monitoring well CMSMW-8 which is located in the fill unit on the southeasterly perimeter of the facility had a mercury concentration of 3.9 ug/L. Hence, the discharge area is 2200 ft x 12 ft or 26,400 ft². The average

⁵ The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

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volumetric flow rate for the Trenton Channel as taken from the "June 2002, BASF Wyandotte North Works Corrective Measures Groundwater Modeling Conceptual Hydrogeologic Model and Model Calibration Report" (Waterloo Report), written by Waterloo Hydrogeologic purport that the flow in the Channel is approximately 45,900 ft³/sec. The average horizontal gradient as taken from potentiometric surface maps of the fill unit (upper aquifer) is 1.5E-03 ft/ft. The geometric mean hydraulic conductivity (K) value computed from slug test data as taken from Waterloo Report is 6.62ft./day. Hence,

$$(Q_{sw}) = 45,900 \text{ ft}^3/\text{sec} * 60 \text{ sec}/\text{min} * 60 \text{ min}/\text{hr} * 24 \text{ hr}/\text{day} = 3.96576\text{E}+09 \text{ ft}^3/\text{day}$$

Calculated Groundwater Flux

$$Q_{gw} = (K) (I) (A)$$

$$Q_{gw} = 6.62 \text{ ft}/\text{day} * 1.5\text{E}-03 \text{ ft}/\text{ft} * 26,400 \text{ ft}^2 = 262.152 \text{ ft}^3/\text{day}$$

Estimated Surface Water Concentration (C_{sw}) After Discharge

Concentration in surface water computed using the following model:

$$(C_{gw}) (Q_{gw}) = (C_{sw}) \{ (Q_{gw}) + (0.1) (Q_{sw}) \}$$

C_{gw} = mercury concentration in groundwater at CMSMW-8 3.9 ug/L

Q_{gw} = 262.152 ft³/day, calculated groundwater flux

C_{sw} = X (concentration of mercury in surface water body i.e., Trenton Channel)

Q_{sw} = 3.96576E+09 ft³/day, surface water body flow rate

The table below illustrates the resulting surface water concentrations of the four constituent of concern using the mixing-zone model. The modeled concentrations are then compared to the most recent surface water quality data as well as the State of Michigan, Part 4, Rule 57 Water Quality Values which are the appropriate surface water criteria for the BASF North Works Site. The State of Michigan, Part 4, Rule 57 Water Quality Standards are calculated surface water quality values to protect, human, wildlife and aquatic life.

Constituent	Stratigraphic Unit	Ground water Sample (ug/L)	MI Rule 57 water Quality Value (ug/L)	Calculated Groundwater Discharge (Mixing Zone) ug/L	Conc. Acceptable Passes or Fails MI Rule 57 Water Quality Criteria
(CMSMW-8) mercury	fill	3.9	1.8 E-03 (HNV)*	2.578E-06	Passes Criteria
(RFIMW-09) aldrin	sand	0.5	1.2E-04 (HCV)*	5.74E-08	Passes Criteria
(RFIMW-09) arochlor	sand	1	2.6E-05(HCV)*	1.148E-07	Passes Criteria

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(RFIMW-22) cyanide	sand	46,000	600 (HCV)*	5.02E-03	Passes Criteria
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Note: The calculations for the sand unit were computed exactly as for the fill unit. The only variables to change were the volumetric flow rate (Q_{gw}) for the groundwater flux for the sand unit. This is due to a change in the hydraulic conductivity (K) computed for the sand unit which was a geometric mean of 2.53 ft/day, a different gradient computed from potentiometric surface maps from the sand unit (I), which was computed to be 1 ft/1600 ft or 6.25E-04 ft/ft; and the area (A) was computed at a width of 1600 ft and a height of 18 ft, which equaled 28,800 ft². Hence the resulting groundwater flux (Q_{gw}) in the sand unit was computed at 45.53 ft³/day

The resulting estimated surface water constituent concentrations computed from the mixing zone model, illustrates that all four constituents of concern, i.e., mercury, aldrin, arochlor 1254 and cyanide are all within the State of Michigan Part 4, Rule 57 Water Quality Criteria. Hence, the current groundwater discharge of mercury as well as the other constituent of concern can be considered currently acceptable.

footnotes:

* HNV - Human noncancer value, drinking and non-drinking as per Rule 57 Water Quality Values

* HCV - Human cancer value, drinking and non-drinking as per Rule 57 Water Quality Values

References:

ENSR International, CMS Supplemental Groundwater Sampling Results, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 September 2004

ENSR International, Risk Screening Summary Report, for the BASF North Works Facility, Wyandotte, Michigan, April 2005

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Waterloo Hydrogeologic, Inc., BASF Wyandotte North Works Corrective Measures Study Groundwater Modeling, Conceptual Hydrogeologic Model & Model Calibration Report

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7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

X

—

If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

If no - enter "NO" status code in #8.

If unknown - enter "IN" status code in #8.

—

—

Rationale and Reference(s):

The USEPA will propose as part of the final remedial corrective action to be implemented at the facility to be published in a Statement of Basis Document that on-going groundwater monitoring will be required at the BASF Corporation Wyandotte Facility. The facility currently is required to collect routine groundwater samples as well as monitor the effectiveness of the groundwater extraction wells as part of their requirements under the State of Michigan 1986 Consent Decree.

References:

ENSR International, CMS Supplemental Groundwater Sampling Results, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 September 2004

ENSR International, Risk Screening Summary Report, for the BASF North Works Facility, Wyandotte, Michigan, April 2005

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Woodward-Clyde Consultants, 1994. RCRA Facility Investigation Report of Current Conditions.

**Migration of Contaminated Groundwater Under Control
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8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

X

YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the BASF Corporation North Works, Wyandotte, Michigan facility, EPA ID # **MID 064 197 742**, located at 1609 Biddle Avenue, Wyandotte, Michigan.. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

or expected.

NO - Unacceptable migration of contaminated groundwater is observed

IN - More information is needed to make a determination.

Completed by	(signature)		Date	
	(print)	Juan Thomas		
	(title)	Environmental Scientist		

Supervisor	(signature)		Date	
	(print)	George Hamper		
	(title)	Corrective Action Section Chief		
	(EPA Region or State)	Region 5		

Locations where References may be found:

**Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA750)**

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Locations where References may be found:

USEPA Records Center
77 W. Jackson
Chicago, IL. 60605

Contact telephone and e-mail numbers

(name)	Juan Thomas
(phone #)	312-886-6010
(e-mail)	thomas.juan@epa.gov



David Slayton
<slaytond@michigan.gov>
02/22/2006 07:50 AM

To
Subject Re: BASF Northworks - Wyandotte, MI EI 750 Determination

History:

~~This message has been replied to and forwarded.~~

Thank you for sending the draft EI 750 (groundwater under control) for the BASF North Works Facility for my review. I checked with other staff, and we do have some comments for you.

It has been the position of the MDEQ's Waste and Hazardous Materials Division that in order to use a Mixing Zone Determination (and the resultant allowable concentrations) in an EI, that the mixing zone proposal would have to have a State of Michigan review through our Water Bureau. My understanding is that Michigan has the authority to review that type of discharge to a surface water body, and the EPA does not.

The other issue is that our Water Bureau does not normally issue a mixing zone for bioaccumulative compounds of concern (BCC) like mercury and PCB's. That is particularly true for the Great Lakes and their connecting water bodies. In accordance with R 323.1082(6), a mixing zone is not allowed for a new discharge of BCCs (i.e. mercury and PCBs) to the surface waters of the state. An existing discharge of a BCC may be afforded a mixing zone through March 23, 2007, if the receiving water concentration is shown to be less than applicable water quality standards for that BCC. An existing discharge of a BCC is defined as a groundwater contaminant plume containing BCCs that had reached surface water before July 1997. Therefore a mixing zone could be pursued at this site (through the State of Michigan, Water Bureau), but if approved, the discharge of mercury and PCBs would need to be stopped by March 23, 2007.

So for purposes of this EI, it is not appropriate to cite an EPA calculated mixing zone determination. The mixing zone would need to be reviewed and approved by the Water Bureau of the State of Michigan. If it is indicated that the mixing zone could be authorized then the EI 750 would be appropriate to determine it is controlled. At that point in time, the ongoing discharge would simply need a finalized proposal to officially authorize the discharge on a five year basis. However, if it is determined that the mixing zone cannot be authorized, then further measures must be implemented for the EI 750. If you have more questions, please contact Mr. Ron Stone (stonera@michigan.gov, 517-373-7141) of our office, who is our expert on mixing zones.

David Slayton, Acting Unit Chief
Hazardous Waste Technical Support Unit
Hazardous Waste Section
Waste & Hazardous Materials Division, MDEQ
517-373-8012 slaytond@michigan.gov

>>> <Thomas.Juan@epamail.epa.gov> 2/17/06 1:43 PM >>>
Dave,

Thanks for your help today during our call. Here is a copy of the document that we discussed. The folks at BASF Corporation are interested in MDEQ's input on the Mixing Zone Calculation as conducted in this EI 750 Analysis. I will await your comments. Thanks.

Juan Thomas



Juan Thomas/R5/USEPA/US
02/22/2006 09:03 AM

To: David Slayton <slaytond@michigan.gov>
cc
bcc
Subject: Re: BASF Northworks - Wyandotte, MI EI 750 Determination

Dave,

Thanks for your timely response on this. As you may recall, my objective in requesting your review of this EI 750 Determination was for me to provide some feedback to the folks at the BASF Northworks facility. Because they are moving into the corrective measures/remedy selection phase of the RCRA Corrective Action process, MDEQ's input relative to our computed Mixing Zone Analysis is important for the management team at the BASF Corporation facility in developing potential viable remedial options at their facility. I would be interested in further discussing your comments, so perhaps we could arrange another conference call sometime soon as your schedule permits. Thanks.

Juan Thomas, Environmental Scientist
U.S. EPA, Region 5, Chicago, Illinois
Enforcement & Compliance Assurance Branch
RCRA Corrective Action Section
(312) 886-6010
(312) 353-4342 (fax)
thomas.juan@epa.gov

-----David Slayton <slaytond@michigan.gov> wrote: -----

To: Juan Thomas/R5/USEPA/US@EPA
From: David Slayton <slaytond@michigan.gov>
Date: 02/22/2006 05:50AM
Subject: Re: BASF Northworks - Wyandotte, MI EI 750 Determination

Thank you for sending the draft EI 750 (groundwater under control) for the BASF North Works Facility for my review. I checked with other staff, and we do have some comments for you.

It has been the position of the MDEQ's Waste and Hazardous Materials Division that in order to use a Mixing Zone Determination (and the resultant allowable concentrations) in an EI, that the mixing zone proposal would have to have a State of Michigan review through our Water Bureau. My understanding is that Michigan has the authority to review that type of discharge to a surface water body, and the EPA does not.

The other issue is that our Water Bureau does not normally issue a mixing zone for bioaccumulative compounds of concern (BCC) like mercury and PCB's. That is particularly true for the Great Lakes and their connecting water bodies. In accordance with R 323.1082(6), a mixing zone is not allowed for a new discharge of BCCs (i.e. mercury and PCBs) to the surface waters of the state. An existing discharge of a BCC may be afforded a mixing zone through March 23, 2007, if the receiving water concentration is shown to be less than applicable water quality standards for that BCC.

An existing discharge of a BCC is defined as a groundwater contaminant plume

containing BCCs that had reached surface water before July 1997. Therefore a mixing zone could be pursued at this site (through the State of Michigan, Water Bureau), but if approved, the discharge of mercury and PCBs would need to be stopped by March 23, 2007.

So for purposes of this EI, it is not appropriate to cite an EPA calculated mixing zone determination. The mixing zone would need to be reviewed and approved by the Water Bureau of the State of Michigan. If it is indicated that the mixing zone could be authorized then the EI 750 would be appropriate to determine it is controlled. At that point in time, the ongoing discharge would simply need a finalized proposal to officially authorize the discharge on a five year basis. However, if it is determined that the mixing zone cannot be authorized, then further measures must be implemented for the EI 750. If you have more questions, please contact Mr. Ron Stone (stonera@michigan.gov, 517-373-7141) of our office, who is our expert on mixing zones.

David Slayton, Acting Unit Chief
Hazardous Waste Technical Support Unit
Hazardous Waste Section
Waste & Hazardous Materials Division, MDEQ
517-373-8012 slaytond@michigan.gov

>>> <Thomas.Juan@epamail.epa.gov> 2/17/06 1:43 PM >>>

Dave,

Thanks for your help today during our call. Here is a copy of the document that we discussed. The folks at BASF Corporation are interested in MDEQ's input on the Mixing Zone Calculation as conducted in this EI 750 Analysis. I will await your comments. Thanks.
Juan Thomas

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

RCRA Corrective Action

Environmental Indicator (EI) RCRIS code (CA750)

Migration of Contaminated Groundwater Under Control

Facility Name: BASF Inc. (North Works Facility)
Facility Address: 1609 Biddle Ave., Wyandotte, MI 48192
Facility EPA ID #: MID 064 197 742

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

 X If yes - check here and continue with #2 below.
 If no - re-evaluate existing data, or
 if data are not available skip to #6 and enter "IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

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2. Is **groundwater** known or reasonably suspected to be "**contaminated**"¹ above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

- X If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.
- If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."
- If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Groundwater is known to be contaminated above the National Primary Drinking Water Regulations Maximum Contaminant Levels and the applicable sections of the Michigan Act 451, Part 201 generic cleanup criteria for groundwater. The applicable Michigan Act 451, Part 201 generic cleanup criteria for groundwater include Groundwater Contact Criteria, and the Groundwater/Surface Water Interface Criteria. There are no present users of on-site groundwater and groundwater usage is prohibited as a potable source. In fact, on-site groundwater is not used as a source of drinking water in the city of Detroit and the nearby suburbs such as Wyandotte. The City of Wyandotte, Michigan Plumbing Code state in Article 3, Section P-303, "the water distribution system of any building in which plumbing fixtures are installed shall be connected to a public water main and sewer system, respectively". Hence the contaminated groundwater on-site is prohibited from potable usage by restrictive covenant. Tap water comes from Lake St. Clair and the Detroit River. The February 1999 Phase I Remedial Investigation Report (RFI Report), the March 2000 Corrective Measures Study Field Program Report (CMS Field Report), and the September 2004, CMS Supplemental Groundwater Sampling Results Report all indicate that the BASF Corporation Wyandotte, Michigan facility has had site-wide groundwater contamination. The 230 acre facility has had industrial operations taking place on-site for over one hundred years. Typical operations of the plant changed in around 1980 where the corporation transitioned from the manufacturing of inorganic bulk commodities, to specialty plastics, resins and pharmaceutical products. Historically, groundwater contamination on-site have included metals, pesticides, and various volatile and semi-volatile organic compounds.

The table below highlights contaminants in groundwater that exceeded the Michigan Act 451, Part 201 generic Groundwater/Surface Water Interface Criteria:

¹ "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

Migration of Contaminated Groundwater Under Control
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Well	Constituent	Max. Conc. ug/L	GSI Criteria ug/L	Well	Constituent	Max. Conc. ug/L	GSI Criteria ug/L
RFIMW-01	1,4-Dioxane	120	34	RFIMW-09	Chromium	88	11
native sand	Mercury	0.028	0.0013	native sand	Mercury	0.00137	0.0013
	thallium	7.65	1.2		thallium	9.4	3.7
	total CN	53	5.2		Arochlor 1254	1	0.2
					Aldrin	0.05	0.01
RFIMW-08	Barium	1100	440				
native sand	Chromium	32	11	RFIMW-11	Antimony	8.5	2
	Copper	33	9	native sand	Arsenic	140	150
	Mercury	0.0053	0.0013		Cadmium	4.3	2.2
	total CN	10	5.2		Copper	420	9
	Zinc	240	120		Lead	220	10
					Mercury	0.0016	0.0013
RFIMW-12	Chromium	19	11		Nickel	130	52
fill unit	Mercury	0.0014	0.0013		total CN	52	5.2
	phenol	1100	210		Vanadium	79	12
	thallium	5.9	1.2		Zinc	600	120
	total CN	1800	5.2				
	Vanadium	42	12	CMSMW-2	Mercury	0.434	0.0013
				fill unit	methane	16000	NA
RFIMW-22	1,4-Dioxane	87	34	CMSMW-8	Mercury	3.9	0.0013
native sand	Arsenic	190	50	fill unit			
	benzene	2300	12				
	chlorobenzene	640	47				
	Chromium	61	11				
	Copper	17	9				
	ethylbenzene	53	18				
	Mercury	0.0333	0.0013				
	total CN	46000	5.2				
	Vanadium	500	12				
	vinyl chloride	280	15				

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References:

ENSR International, CMS Supplemental Groundwater Sampling Results, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 September 2004

ENSR International, Risk Screening Summary Report, for the BASF North Works Facility, Wyandotte, Michigan, April 2005

Parsons Engineering Science, Inc., 1998. Update of 1994 RCRA Facility Investigation Report of Current Conditions

Parsons Engineering Science, Inc., RCRA Corrective Measures Study, Field Program Report, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 March 2000

QST Environmental Science (formerly Environmental Science & Engineering, Inc.), Phase I RCRA Facility Investigation Report for BASF-Wyandotte Facility, 26 February 1999

Waterloo Hydrogeologic, Inc., BASF Wyandotte North Works Corrective Measures Study Groundwater Modeling, Conceptual Hydrogeologic Model & Model Calibration Report

Woodward-Clyde Consultants, 1994. RCRA Facility Investigation Report of Current Conditions.

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3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"² as defined by the monitoring locations designated at the time of this determination)?

 X If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"²).

 If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"²) - skip to #8 and enter "NO" status code, after providing an explanation.

 If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

The migration of contaminated groundwater has stabilized and is expected to remain within the existing area of contaminated groundwater. Five stratigraphic units can be described beneath the site. These five units were classified in descending order as the 1) fill unit, 2) clay and peat unit, 3) native sand unit, 4) lacustrine clay unit and 5) bedrock unit. The surface strata are comprised of industrial fill (up to 25ft in thickness). Fill materials (primarily industrial residues generated on-site) were deposited on-site to fill in marshland areas and raise the entire site to its present grade. This fill varied in nature from alkaline lime waste, including distiller blow-off (DBO), to acidic fly ash and cinders. The fill also includes some deposits of relatively clean sand and clay, metal, wood and masonry debris. In most instances, the transition from marshland to fill is sharply defined due to borehole evidence of the original vegetation from the marshland bottoms. In general, the fill rests on peat or organic clays that evolved from the original marsh bottom deposits. Where present, the peat material occurs approximately 5 to 10 ft. below land surface (bls) and ranges up to 13 ft in thickness depending on location, though 2 to 3ft is typical. The layers below the peat (or below the fill where the peat is absent) consist of sands with discontinuous pockets of clay. Sand is prevalent beneath the western portion of the site, but pinches out to clay to the east in parts of the site. The glacial lacustrine clay underlies this sand.

Hydrostratigraphic cross-sections, potentiometric surface maps, and groundwater quality data were used to assess groundwater flow and transport conditions and potential groundwater contaminant migration/stabilization to the Trenton Channel/Detroit River located east of the site. The site has a long seawall that separates the fill from the river (Trenton Channel). There are two forms of construction used. The original seawall measures approximately 4700 ft in length and runs from the northeast corner of the site to a point approximately 850 ft from the southeast corner of the site. It is constructed of double layer of 3 inch thick, overlapping timbers. The remaining 850 ft of shoreline to the south is treated with rip-rap stones. A second seawall, consisting of sheet pilings approximately 40 ft deep runs parallel to the first wall for a distance of approximately 3360 ft from the northeast corner of the site. The steel seawall is keyed into the underlying lacustrine clay, and is separated from the original seawall by approximately

² "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

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2 ft. The joints between steel pilings are not sealed. The seawall has three zones, in terms of resistance to flow, as shown in the table 2 below.

Table 2. Seawall Zones

Construction	Length	Resistance to Horizontal Flow
oak timbers and steel pilings	3360 ft	medium to high
oak timbers only	1340 ft	low
rip-rap	850 ft	none

Groundwater discharge from the BASF Corporation North Works facility is expected to be small because of the combined effects of the natural hydraulic isolation of the site, the groundwater extraction system, (a total of 15 groundwater extraction wells are installed in the south-central portion of the site), and the oak and steel retaining wall erected along the Trenton Channel/Detroit River riverbank. It has been reported that small quantities of water may leave the site by diffuse flow of the Detroit River along portions of the waterfront that does not have a steel retaining wall and by flow patterns across the northern boundary of the site. *An evaluation of the groundwater extraction system as reported in the 1999 Phase I RFI Report concluded that: The extraction system appears to be most effective in the southern half of the facility where a majority of the horizontal hydraulic gradients are essentially flat or slightly toward the interior of the facility. In contrast, horizontal gradients towards the river along the northern portion of the facility indicate a reasonable potential for off-site migration in these areas. The presence of a groundwater "divide" is indicated roughly parallel to the river along the eastern side of the facility. Although its location cannot be precisely defined at this time, this divide supports the conclusion that a component of groundwater is likely discharging to the river.*

Groundwater contour maps have been constructed for both the fill and native sand units. Pumping test illustrated that the fill unit and native sand unit are hydraulically disconnected. The flow direction of the groundwater in the fill material shows the groundwater flowing in a general easterly direction toward the Trenton Channel/Detroit River. Potentiometric surface maps of the fill unit illustrated that groundwater is flowing in a north-easterly direction in the northern one third of the facility, and in the remainder of the facility there is a southerly component of groundwater flow direction. There is apparent groundwater divide running approximately through monitoring wells CMSMW-16 and RFIMW-5 and could be attributed to the presence of DBO (Distiller Blow-off), material present south and east of these two wells. The pattern of the contour lines in the vicinity of these two wells most likely indicate the flow of groundwater around the DBO fill material which is known to have a relatively low permeability. Potentiometric surface maps of the sand unit illustrate that groundwater flow in the native sand unit closely mimics the groundwater flow in the fill unit, although for different reasons. The peat layer that separates the native sand unit and the fill unit is not continuous across the western portion of the north end of the facility. The absence of the clay unit allows the native sand unit and the fill unit to be in better hydraulic communication with each other; hence the similarity of groundwater flow conditions. In the native sand units, the groundwater flow south of the apparent divide in the vicinity of monitoring well CMSMW-5 and RFIMW-6, is towards the south. This flow pattern is attributable to two separate subsurface characteristics: the groundwater extraction system operating in the south-central area of the facility, where the groundwater along the southern edge of the facility is shown to be flowing north towards the extraction system. This indicates that in the native sand unit, the existing groundwater extraction system is preventing groundwater from leaving the site at the southern edge. Additionally groundwater contour maps of the native sand unit illustrate a truncation of the groundwater contour lines in the eastern portion of the facility and this is attributed to the native sand unit pinching out along the western edge of the clay ridge and the presence of the overlying peat unit. As noted during performance of pump testing, the fill unit and the native sand unit are hydraulically disconnected. The isolation of the native sand unit from the fill material coupled with the groundwater surface

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elevations measured in the native sand wells indicate that the native sand unit is at a minimum, semi-confined and groundwater is under some pressure. Although the groundwater elevations measured in the wells screened in the native sand unit are above the elevation of the clay ridge, the overlying peat unit serves as the upper boundary for the groundwater surface. The peat layer covers the native sand unit and the western leg of the clay ridge and prevents (or greatly limits) groundwater in the native sand unit from flowing west, over the clay ridge and into the Trenton Channel/Detroit River.

References:

ENSR International, CMS Supplemental Groundwater Sampling Results, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 September 2004

ENSR International, Risk Screening Summary Report, for the BASF North Works Facility, Wyandotte, Michigan, April 2005

Parsons Engineering Science, Inc., 1998. Update of 1994 RCRA Facility Investigation Report of Current Conditions

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Waterloo Hydrogeologic, Inc., BASF Wyandotte North Works Corrective Measures Study Groundwater Modeling, Conceptual Hydrogeologic Model & Model Calibration Report

Woodward-Clyde Consultants, 1994. RCRA Facility Investigation Report of Current Conditions.

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4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

 X If yes - continue after identifying potentially affected surface water bodies.

 If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

 If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

The presence of a seawall constructed of 3360 ft of oak timbers and steel pilings keyed into the lacustrine clay layer, and 1340 ft of oak timbers only, a groundwater pump and treat system consisting of 15 groundwater extraction wells installed in the south-central portion of the facility and the presence of a clay ridge that pinches out from the southeast portion of the facility that extends and cuts across northeasterly to the approximate central portion of the facility, all combined to serve to retard the flow of off-site groundwater migration to the Trenton Channel. The absence of a retaining wall/seawall on the southeast perimeter of the facility for approximately 850 ft and the permeability of the fill unit (geometric mean hydraulic conductivity (K) value of 6.62 ft/day) and of the native sand unit (geometric mean hydraulic conductivity (K) value of 2.53 ft/day), as well as an analysis of potentiometric surface maps of both the fill and native sand units illustrate that there is some discharge of groundwater to the Trenton Channel/Detroit River.

References:

ENSR International, CMS Supplemental Groundwater Sampling Results, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 September 2004

ENSR International, Risk Screening Summary Report, for the BASF North Works Facility, Wyandotte, Michigan, April 2005

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5. Is the **discharge** of "contaminated" groundwater into surface water likely to be "**insignificant**" (i.e., the maximum concentration³ of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

_____ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration³ of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

X If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration³ of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations³ greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

Approximately 31 groundwater monitoring wells are installed along the northern, eastern, and southern perimeter of the BASF North Works Facility. These wells are installed in either the fill unit aquifer or sand unit aquifer and are all located in close proximity to the Trenton Channel/Detroit River. Both, historical and more recent groundwater sampling analysis have detected constituents that exceeded the applicable Michigan Act 451, Part 201 generic cleanup criteria for groundwater include that included Groundwater Contact Criteria, and the Groundwater/Surface Water Interface Criteria. We assumed that the discharge of contaminated groundwater is potentially significant.

³ As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

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References:

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ENSR International, Risk Screening Summary Report, for the BASF North Works Facility, Wyandotte, Michigan, April 2005

Parsons Engineering Science, Inc., 1998. Update of 1994 RCRA Facility Investigation Report of Current Conditions

Parsons Engineering Science, Inc., RCRA Corrective Measures Study, Field Program Report, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 March 2000

QST Environmental Science (formerly Environmental Science & Engineering, Inc.), Phase I RCRA Facility Investigation Report for BASF-Wyandotte Facility, 26 February 1999

Waterloo Hydrogeologic, Inc., BASF Wyandotte North Works Corrective Measures Study Groundwater Modeling, Conceptual Hydrogeologic Model & Model Calibration Report

Woodward-Clyde Consultants, 1994. RCRA Facility Investigation Report of Current Conditions.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented⁴)?

X If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment,⁵ appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and

⁴ Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

⁵ The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

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contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

_____ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

_____ If unknown - skip to 8 and enter "IN" status code.

Rationale and Reference(s):

A Groundwater-surface water mixing zone determination was computed for four constituent of concern whose concentrations in groundwater were determined to be "significant" based on the constituents's concentrations exceeding the Michigan Act 451, Part 201 Groundwater/Surface Water Interface Criteria as indicated in question #5. These constituent concentrations were taken from perimeter well locations primarily from the eastern side of the facility in front of the seawall or rip-rap barrier wall constructed along the facility fill and Trenton Channel interface. Well locations RFIMW-22 and CMSMW-2 are located along the northern perimeter of the facility. The constituents are mercury, cyanide, aldrin and arochlor 1254 (PCB). Since mercury represents the worst-case site specific constituent (in the fill unit) having probability for groundwater-surface water discharge, mercury in groundwater at monitoring well CMSMW-8 will be evaluated for its acceptability in discharging into the Trenton Channel/Detroit River. Based on the mercury concentration calculated in the mixing zone model, the resulting calculated mixing zone concentration i.e., groundwater to surface water discharge, will be compared to the appropriate surface water protection criteria.

Areas of Groundwater Discharge Associated With Current Exceedences in the Groundwater fill unit

The discharge area is being computed from a horizontal distance of 2200 ft which is the width of the interface of the most likely groundwater migration pathway into the Trenton Channel. This width represents the absence of the steel retaining wall constructed along the Trenton Channel Riverbank. The height of the interface is 12 ft as taken from geological cross-section maps. Groundwater monitoring well CMSMW-8 which is located in the fill unit on the southeasterly perimeter of the facility had a mercury concentration of 3.9 ug/L. Hence, the discharge area is 2200 ft x 12 ft or 26,400 ft². The average volumetric flow rate for the Trenton Channel as taken from the "June 2002, BASF Wyandotte North Works Corrective Measures Groundwater Modeling Conceptual Hydrogeologic Model and Model Calibration Report" (Waterloo Report), written by Waterloo Hydrogeologic purport that the flow in the Channel is approximately 45,900 ft³/sec. The average horizontal gradient as taken from potentiometric surface maps of the fill unit (upper aquifer) is 1.5E-03 ft/ft. The geometric mean hydraulic conductivity (K) value computed from slug test data as taken from Waterloo Report is 6.62ft./day. Hence,

$$(Q_{sw}) = 45,900 \text{ ft}^3/\text{sec} * 60 \text{ sec}/\text{min} * 60 \text{ min}/\text{hr} * 24 \text{ hr}/\text{day} = 3.96576\text{E}+09 \text{ ft}^3/\text{day}$$

Calculated Groundwater Flux

$$Q_{gw} = (K) (I) (A)$$

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$$Q_{gw} = 6.62 \text{ ft/day} * 1.5E-03 \text{ ft/ft} * 26,400 \text{ ft}^2 = 262.152 \text{ ft}^3/\text{day}$$

Estimated Surface Water Concentration (Csw) After Discharge

Concentration in surface water computed using the following model:

$$(C_{gw}) (Q_{gw}) = (C_{sw}) \{ (Q_{gw}) + (0.1) (Q_{sw}) \}$$

C_{gw} = mercury concentration in groundwater at CMSMW-8 3.9 ug/L

Q_{gw} = 262.152 ft³/day, calculated groundwater flux

C_{sw} = X (concentration of mercury in surface water body i.e., Trenton Channel)

Q_{sw} = 3.96576E=09 ft³/day, surface water body flow rate

The table below illustrates the resulting surface water concentrations of the four constituent of concern using the mixing-zone model. The modeled concentrations are then compared to the most recent surface water quality data as well as the State of Michigan, Part 4, Rule 57 Water Quality Values which are the appropriate surface water criteria for the BASF North Works Site. The State of Michigan, Part 4, Rule 57 Water Quality Standards are calculated surface water quality values to protect, human, wildlife and aquatic life.

Constituent	Stratigraphic Unit	Ground water Sample (ug/L)	MI Rule 57 water Quality Value (ug/L)	Calculated Groundwater Discharge (Mixing Zone) ug/L	Conc. Acceptable Passes or Fails MI Rule 57 Water Quality Criteria
(CMSMW-8) mercury	fill	3.9	1.8 E-03 (HNV)*	2.578E-06	Passes Criteria
(RFIMW-09) aldrin	sand	0.5	1.2E-04 (HCV)*	5.74E-08	Passes Criteria
(RFIMW-09) arochlor 1254	sand	1	2.6E-05(HCV)*	1.148E-07	Passes Criteria
(RFIMW-22) cyanide	sand	46,000	600 (HCV)*	5.02E-03	Passes Criteria

Note: The calculations for the sand unit were computed exactly as for the fill unit. The only variables to change were the volumetric flow rate (Q_{gw}) for the groundwater flux for the sand unit. This is due to a change in the hydraulic conductivity (K) computed for the sand unit which was a geometric mean of 2.53 ft/day, a different gradient computed from potentiometric surface maps from the sand unit (I), which was computed to be 1 ft/1600 ft or 6.25E-04 ft/ft; and

the area (A) was computed at a width of 1600 ft and a height of 18 ft, which equaled 28,800 ft². Hence the resulting groundwater flux (Q_{gw}) in the sand unit was computed at 45.53 ft³/day

**Migration of Contaminated Groundwater Under Control
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The resulting estimated surface water constituent concentrations computed from the mixing zone model, illustrates that all four constituents of concern, i.e., mercury, aldrin, arochlor 1254 and cyanide are all within the State of Michigan Part 4, Rule 57 Water Quality Criteria. Hence, the current groundwater discharge of mercury as well as the other constituent of concern can be considered currently acceptable.

footnotes:

* HNV - Human noncancer value, drinking and non-drinking as per Rule 57 Water Quality Values

* HCV - Human cancer value, drinking and non-drinking as per Rule 57 Water Quality Values

References:

ENSR International, CMS Supplemental Groundwater Sampling Results, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 September 2004

ENSR International, Risk Screening Summary Report, for the BASF North Works Facility, Wyandotte, Michigan, April 2005

Parsons Engineering Science, Inc., 1998. Update of 1994 RCRA Facility Investigation Report of Current Conditions

Parsons Engineering Science, Inc., RCRA Corrective Measures Study, Field Program Report, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 March 2000

QST Environmental Science (formerly Environmental Science & Engineering, Inc.), Phase I RCRA Facility Investigation Report for BASF-Wyandotte Facility, 26 February 1999

Waterloo Hydrogeologic, Inc., BASF Wyandotte North Works Corrective Measures Study Groundwater Modeling, Conceptual Hydrogeologic Model & Model Calibration Report

Woodward-Clyde Consultants, 1994. RCRA Facility Investigation Report of Current Conditions.

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7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

 X If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

 If no - enter "NO" status code in #8.

 If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

The USEPA will propose as part of the final remedial corrective action to be implemented at the facility to be published in a Statement of Basis Document that on-going groundwater monitoring will be required at the BASF Corporation Wyandotte Facility. The facility currently is required to collect routine groundwater samples as well as monitor the effectiveness of the groundwater extraction wells as part of their requirements under the State of Michigan 1986 Consent Decree.

References:

ENSR International, CMS Supplemental Groundwater Sampling Results, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 September 2004

ENSR International, Risk Screening Summary Report, for the BASF North Works Facility, Wyandotte, Michigan, April 2005

Parsons Engineering Science, Inc., 1998. Update of 1994 RCRA Facility Investigation Report of Current Conditions

Parsons Engineering Science, Inc., RCRA Corrective Measures Study, Field Program Report, for the BASF North Works Facility, Wyandotte, Michigan, USEPA ID MID 064197742 March 2000

QST Environmental Science (formerly Environmental Science & Engineering, Inc.), Phase I RCRA Facility Investigation Report for BASF-Wyandotte Facility, 26 February 1999

Waterloo Hydrogeologic, Inc., BASF Wyandotte North Works Corrective Measures Study Groundwater Modeling, Conceptual Hydrogeologic Model & Model Calibration Report

Woodward-Clyde Consultants, 1994. RCRA Facility Investigation Report of Current Conditions.

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8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

 X YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the BASF Corporation North Works, Wyandotte, Michigan facility, EPA ID # MID 064 197 742, located at 1609 Biddle Avenue, Wyandotte, Michigan. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

 NO - Unacceptable migration of contaminated groundwater is observed or expected.

 IN - More information is needed to make a determination.

Completed by

(signature)

(print) Juan Thomas

(title)

Environmental Scientist

Date

9-30-2005

Supervisor

(signature)

(print)

George Hamper

(title)

Corrective Action Section Chief

(EPA Region or State) Region 5

Date

9-30-05

Locations where References may be found:

USEPA Records Center
77 W. Jackson
Chicago, IL. 60605

Contact telephone and e-mail numbers

(name)

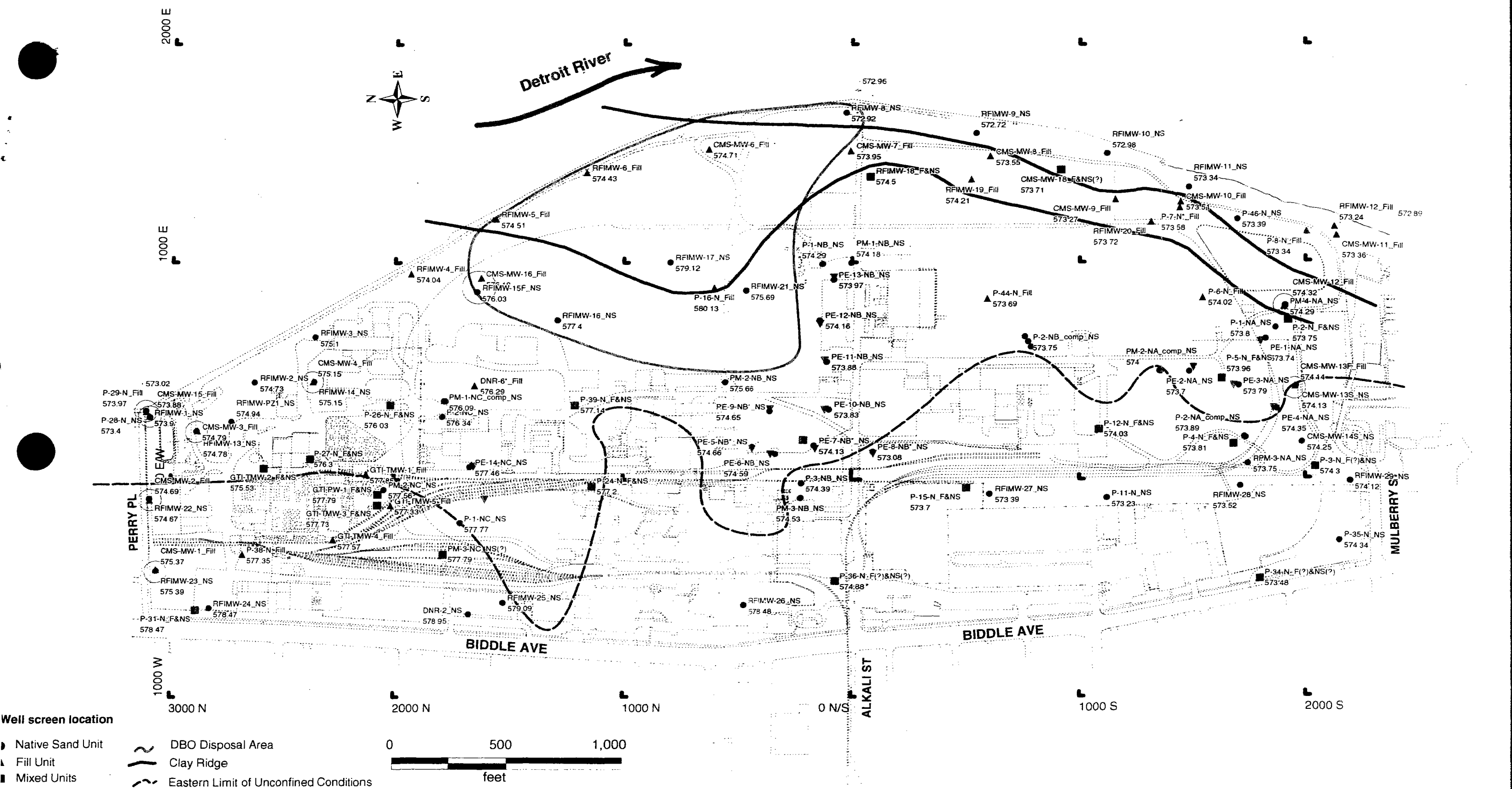
Juan Thomas

(phone #)

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(e-mail)

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DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

RCRA Corrective Action Environmental Indicator (EI) RCRIS code (CA725)

Current Human Exposures Under Control

Facility Name: BASF Inc. (North Works Facility)
Facility Address: 1609 Biddle Ave., Wyandotte, MI 48192
Facility EPA ID #: MID 064 197 742

1. Has **all** available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water/sediments, and air, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

 X If yes - check here and continue with #2 below.
 If no - re-evaluate existing data, or
 if data are not available skip to #6 and enter "IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Current Human Exposures Under Control" EI

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

**Current Human Exposures Under Control
Environmental Indicator (EI) RCRIS code (CA725)**

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2. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be **"contaminated"**¹ above appropriately protective risk-based "levels" (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action (from SWMUs, RUs or AOCs)?

	<u>Yes</u>	<u>No</u>	<u>?</u>	<u>Rationale / Key Contaminants</u>
Groundwater	X			Metals, VOC and SVOC
Air (indoors) ²		X		No buildings above the contaminated subsurface soil. Groundwater contaminants did not exceed the indoor volatilization criteria.
Surface Soil (e.g., <2 ft)	X			Arsenic, 1,2 Dichloropropane, bis(2-chlorisopropyl)ether and SVOCs
Surface Water	X			A total of 19 wells exceeded the part 201 groundwater surface water interface criteria for a wide range of contaminants.
Sediment	X			PAH, PCB, polychlorinated naphthalene and polychlorinated terphenyls.
Subsurf. Soil (e.g., >2 ft)	X			Chemicals exceeded criteria (see below)
Air (outdoors)	X			Benzene, naphthalene, 1,2 dichlopropane through soil volatilization criteria

_____ If no (for all media) - skip to #6, and enter "YE," status code after providing or citing appropriate "levels," and referencing sufficient supporting documentation demonstrating that these "levels" are not exceeded.

X If yes (for any media) - continue after identifying key contaminants in each "contaminated" medium, citing appropriate "levels" (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

_____ If unknown (for any media) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):

The 1999 Phase I RFI evaluated the nature and extent of four solid waste management units (SWMU's),

¹ "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriately protective risk-based "levels" (for the media, that identify risks within the acceptable risk range).

² Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggest that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

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and five areas of concern (AOC). Subsequent to the completion of the Phase I RFI Report, two additional AOC's (AOC 1 and AOC 8) were investigated as part of a "Toluene Remediation Investigation". The exposures of workers to contaminated surface soils/fill as well as subsurface soils are reasonably expected to be significant because surface/subsurface soil/fill concentrations are above the applicable Michigan Department of Environmental Quality (MDEQ) Part 201 of Michigan Act 451 generic screening levels at numerous SWMU's and AOC's at the site. The applicable generic Part 201 soil screening criteria includes: industrial and commercial drinking water criteria, groundwater contact protection criteria, soil volatilization to indoor air inhalation criteria, infinite source volatile soil inhalation criteria for ambient air, particulate soil inhalation criteria, industrial and commercial II direct contact criteria and groundwater surface water interface protection criteria. Surficial and subsurface on-site soil contamination exceeded the most stringent of these criteria at several of the SWMU's and AOC's.

The site is currently active with daily chemical production and manufacturing activities taking place. The Phase I RFI soil sampling data revealed that all areas (SWMU's and AOC's) investigated (with the exception of one area RFIMW 08) exceeded at least one of the most conservative generic Part 201 soil screening criteria. The following summarizes the SWMU's and AOC's where generic Part 201 soil screening criteria were exceeded and hence can be reasonably expected to be pose as a significant exposure to applicable receptor populations: a) AOC 2 - arsenic exceeds the direct contact criteria, b) AOC 4 - several PAH's, i.e., benzo(a)anthracene, benzo(b)pyrene, benzo(b)fluoroanthracene, benzo(k)fluoroanthracene, chrysene, indeno(1,2,3-CD)pyrene, naphthalene, and phenanthrene exceed the soil direct contact criteria with several PAH's also exceeding the soil volatilization indoor air criteria and the infinite source volatile soil inhalation criteria for ambient air, c) AOC 6 - arsenic, benzene, benzo(a)pyrene, benzo(b)fluoroanthracene, dibenz(A,H)anthracene exceeded the soil direct contact criteria with benzene also exceeding the soil volatilization to indoor air inhalation criteria and the groundwater protection criteria. AOC7A, 7C, and SWMU G and H exceeded the direct contact criteria, and SWMU F and SWMU H exceeded direct contact criteria as well as ambient volatilization criteria.

References: (1) BASF Corporation, Final Phase I RCRA Facility Investigation Report, Vol. 1-3, February 1999; (2) BASF Corporation, RCRA Corrective Measures Study Field Program Report, March 2000; (3) BASF Corporation Risk Screening Summary Report, April 2005

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3. Are there **complete pathways** between "contamination" and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table

Potential **Human Receptors** (Under Current Conditions)

"Contaminated" Media	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food ³
Groundwater	No	No	No	Yes	No	No	No
Air (indoors)							
Soil (surface, e.g., <2 ft)	No	Yes	No	Yes	No	No	No
Surface Water							
Sediment							
Soil (subsurface e.g., >2 ft)	No	No	No	Yes	No	No	No
Air (outdoors)	No	Yes	No	Yes	No	No	No

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors' spaces for Media which are not "contaminated" as identified in #2 above.
2. enter "yes" or "no" for potential "completeness" under each "Contaminated" Media -- Human Receptor combination (Pathway).

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media - Human Receptor combinations (Pathways) do not have check spaces ("___"). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

_____ If no (pathways are not complete for any contaminated media-receptor combination) - skip to #6, and enter "YE" status code, after explaining and/or referencing condition(s) in-place, whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (e.g., use optional Pathway Evaluation Work Sheet to analyze major pathways).

X If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) - continue after providing supporting explanation.

If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):

Although contaminated, groundwater, surface water and sediment may not provide complete exposure pathway for the potential receptors for the following reasons:

All of the contamination is on-site. There are no residences, day-care, recreational opportunities, or food production

³ Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

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on-site. The site is completely fenced to prevent trespassers from coming on-site. On-site groundwater is not used as a source of drinking water in Detroit and the nearby suburbs such as Wyandotte. The City of Wyandotte, Michigan Plumbing Code state in Article 3, Section P-303 "the water distribution system of any building in which plumbing fixtures are installed shall be connected to a public water main and sewer system, respectively". Hence the contaminated groundwater on-site is prohibited from potable usage by restrictive covenant. Tap water comes from Lake St. Clair and the Detroit River.

The Michigan Department of Environmental Quality (MDEQ) performed a sediment investigation in the Trenton Channel of the Detroit River. The results of this investigation are presented in a report entitled *Results of the Trenton Channel Project Summary Surveys 1993-1996*, dated July 1997. That report documents the presence of metals, PAHs, PCBs, oil and grease, and other contaminants throughout the Trenton Channel. Other industrial facilities located along the Trenton Channel have contributed to the sediment contamination, and this facility might have contributed as well. Trenton Channel sediment issues will be addressed through a separate project under the supervision of U.S. EPA's Great Lakes Program Office and the MDEQ. Accordingly, the sediment issues are outside the scope of this environmental indicator determination.

Consumption of fish from the Detroit River is limited due to several fish advisories. There is currently an advisory banning consumption of carp. There are also fish consumption advisories for freshwater drum, northern pike (for women and children), redhorse sucker (for women and children), walleye, and yellow perch (for women and children). These fish consumption advisories are size-dependent. Consult the *Michigan Fish Advisory Guide* for species lengths.

Although the groundwater is contaminated, a subsurface barrier wall and pump and treatment system are already in place to minimize the migration of contaminated ground water to Detroit river.

Five AOCs and three SWMUS were identified with exceedance of part 201 screening criteria through one or more exposure pathways. The Current worker activity is limited to either maintenance or facility workers. Maintenance workers are responsible for routine landscaping (i.e. grass cutting) and other minor repair activities and hence may be exposed to contaminated on-site soils. In addition, this receptor population may become exposed to on-site contaminants via inhalation of volatile organic compounds from contaminated surficial soils. Construction/Utility Workers may be required to perform soil excavations, trenching or other construction activities during a specified time period and hence may become exposed to contaminated surficial and subsurface soils and contaminated groundwater.

References: (1) BASF Corporation, Final Phase I RCRA Facility Investigation Report, Vol. 1-3, February 1999; (2) BASF Corporation, RCRA Corrective Measures Study Field Program Report, March 2000; (3) BASF Corporation Risk Screening Summary Report, April 2005; (4) Results of the Trenton Channel Project Summary Surveys 1993-1996, Michigan Department of Environmental Quality and USEPA, July 1997.

4. Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be "**significant**"⁴ (i.e., potentially "unacceptable" because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable

⁴ If there is any question on whether the identified exposures are "significant" (i.e., potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

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"levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

- X If no (exposures can not be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."
- If yes (exposures could be reasonably expected to be "significant" (i.e., potentially "unacceptable") for any complete exposure pathway) - continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are not expected to be "significant."
- If unknown (for any complete pathway) - skip to #6 and enter "IN" status code

Rationale and Reference(s): The soil contamination identified in different SWMUs and AOCs although present complete exposure pathway for routine workers, it is unlikely that the exposure is considered significant. The rationale is provided below for the individual SWMUS and AOCs.

The maximum arsenic concentration that exceeded the screening criteria of 37 ppm in surface soil for direct contact criteria was 41 ppm, 62.4 ppm and 101 ppm respectively for AOC2, AOC 7A and SWMU G. Although the maximum concentration exceeded the screening criteria, the average concentration of arsenic in these areas were found to be well below the screening concentration and as a result considered to be equivalent to less than 1e-05.

SWMU H: The maximum subsurface soil concentration of 1,2 dichloropropane in SWMU-H is 50000 ppm with an average concentration of 4570 ppm when compared to the part 201 screening criteria of 7.4 ppm for indoor air volatilization, 31 ppm for ambient air volatilization and 550 ppm for direct contact. Although the mean concentration of 1,2 dichloropropane exceeded all these criteria the most relevant pathway is infinite source soil volatilization influencing ambient air inhalation. There are no occupied structures above this trench and therefore indoor air is not a medium of concern. Routine workers and construction workers normally under current conditions are not likely exposed to subsurface soil contamination. SWMU H is a group of ditches that have all been filled in with relatively clean material with grass growing on it. Since SWMU H and AOC 5 lie in dichloropropane area, This area was assessed for VOC emission rates. Air samples were collected from the flux chamber. Three sample locations were sampled three times each. At each location, samples were collected on three different days. The analytical data from these three locations were then compared to ambient air concentration. 1,2 dichloropropane was not detected in any of these locations and in the ambient air with the reporting limit of 0.8 ppb. Literature suggests that 1,2 dichloropropane has been detected at low levels in ambient air with an average level in air of about 0.022 ppb. Although the air analysis warrants further investigation with respect to more sensitive detection limits, for EI determination, the reported detection limits were compared against OSHA PEL limits. The exposure to ambient air concentration of for routine workers was found to be significantly less compared to OSHA PEL at 72.3 ppm.

SWMU F: The maximum concentration of Arsenic at 63.9 ppm exceeded the direct contact criteria. However, the average concentration of 23.2 ppm in soil was lesser than the screening criteria of 37 ppm. 1,2 dichloropropane in soil exceeded ambient air volatilization criteria. However, ambient air analysis confirmed the insignificance of this exposure pathway. 1,2 dichloropropane found at 0.8 ppb in ambient air was considerably lesser than OSHA PEL

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of 72.3 ppm.

AOC 4: The maximum and mean concentration of benzopyrene, benzoanthracene, benzo(b)fluoranthene, indenopyrene, benzo(k)fluoranthene exceeded soil direct contact criteria. Phenanthrene, toluene, naphthalene, benzene, benzopyrene and chrysene exceeded one or more part 201 risk screening criteria. AOC-4 is a tar pit that has been covered with gravel. All of the sample results reported for AOC-4 are subsurface soil samples. The contaminants identified in subsurface soil do not pose risk to routine workers or construction workers through direct contact at current conditions. However, ambient volatilization from subsurface may be of significant concern to routine workers. There is no evidence to indicate that coal tar might ooze upward through the gravel. Benzene and naphthalene were the two major contaminants identified exceeding the inhalation criteria. The ambient air concentration of 0.62 ppb of benzene detected in the site is found to be much lesser than OSHA PEL limit of 1ppm. Naphthalene was not detected in the ambient air at a reporting limit of 0.74 ppb which is significantly less compared to a OSHA PEL of 10 ppm.

AOC-6 :The maximum concentration of benzopyrene, arsenic , benzene, benzoanthracene, dibenzathracene and benzo(b)fluoranthene exceeded the soil direct contact criteria. The sample results reported for AOC-6 are all subsurface soil samples. Except benzopyrene the average concentration of other constituents were under the screening criteria. Although the average concentration of benzopyrene at 13.9ppm exceeded the screening criteria at 8 ppm, routine workers may not be at risk since the contamination is at subsurface. AOC 6 is a tar pit that has been covered with soil and has grass growing on it. Further, the limited exposure period which is approximately 1 hour per day in the contaminated location would likely result in higher screening criteria than compared to 8 hour exposure period as suggested by part 201 exposure assumptions. Benzene and naphthalene were the two major contaminants identified exceeding the inhalation criteria in this AOC . The ambient air concentration of 0.62 ppb of benzene detected in the site is found to be much lesser than OSHA PEL limit of 1ppm. Naphthalene was not detected in the ambient air at a reporting limit of 0.74 ppb which is significantly less compared to a OSHA PEL of 10 ppm.

Any subsurface excavation work would be covered by the facility's health and safety plan. Construction workers would be required to use the appropriate personal protective equipment to prevent unacceptable human health exposures whenever they come in direct contact with highly contaminated subsurface soils, buried wastes, or contaminated groundwater.

References: (1) BASF Corporation, Final Phase I RCRA Facility Investigation Report , Vol. 1-3, February 1999; (2) BASF Corporation, RCRA Corrective Measures Study Field Program Report, March 2000; (3) BASF Corporation Risk Screening Summary Report, April 2005

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5. Can the "significant" **exposures** (identified in #4) be shown to be within **acceptable** limits?

- _____ If yes (all "significant" exposures have been shown to be within acceptable limits) - continue and enter "YE" after summarizing and referencing documentation justifying why all "significant" exposures to "contamination" are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).
- _____ If no (there are current exposures that can be reasonably expected to be "unacceptable")- continue and enter "NO" status code after providing a description of each potentially "unacceptable" exposure.
- _____ If unknown (for any potentially "unacceptable" exposure) - continue and enter "IN" status code

Rationale and Reference(s):

Current Human Exposures Under Control
Environmental Indicator (EI) RCRIS code (CA725)

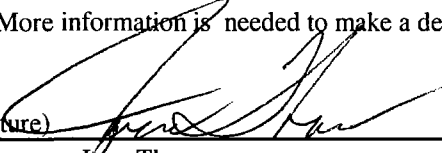
Page 9

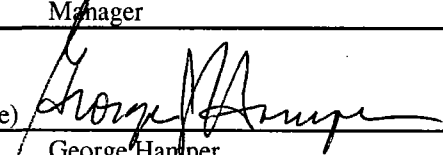
6. Check the appropriate RCRIS status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

 X YE - Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the _____ facility, EPA ID # _____, located at _____ under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

 NO - "Current Human Exposures" are NOT "Under Control."

 IN - More information is needed to make a determination.

Completed by (signature)  Date 6/30/2005
(print) Juan Thomas
(title) Environmental Scientist/Project Manager

Supervisor (signature)  Date 6/30/2005
(print) George Hanper
(title) Corrective Action Section Chief
(EPA Region or State) Region V

B. Sundar

Locations where References may be found:

USEPA Region V
WPTD Records Center
77 W. Jackson Blvd
Chicago, IL. 60604

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(phone #) 312-886-6010
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FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RISK.

Facility Status Report For:

BASF Corp.
MID 064 197 742

BASF Corp.
1609 Biddle Ave.
Wyandotte MI 48192

Contact Information

U.S. EPA:	Diane M. Sharrow	(312) 886-6199
State:	Jon Russell	(734) 953-8905
Legal:	Reginald Pallesen	(312) 886-6055
Facility:	Jack Lanigan	(734) 324-6161
Lead Agency:	Federal - Enforcement	

RCRIS Event Codes

CA075: HI

CA999A:

CA100S:	CA100A: 2/24/94	CA400S: 4/30/01	CA400A:	CA600S:	CA600A:
CA200S:	CA200A: 5/14/98	CA550S: 4/30/02	CA550A:	CA650S:	CA650A:

Environmental Indicators

CA725 Current Human Exposures:

IN More Information Needed

Date of Determination: 6/30/01

Projected Date: 6/30/01

CA750 Migration of Contaminated Groundwater:

IN More Information Needed

Date of Determination: 6/30/01

Projected Date: 6/30/01

Facility Information

Facility Description:

Facility is a 230 acre site located adjacent to the Detroit River. The site has over a 100 year operating history, that includes the filling of 2/3 of the site with various materials. Over 70 contaminants have been identified at the site. BASF conducts research and the manufacture of industrial chemicals, resins, plastics, castings and Vitamins A&E. Currently 1/2 site is clear of buildings and facilities.

Contaminated Media:

Soil and groundwater. Surface water and sediments of the Detroit River Trenton Channel adjacent to the Facility are contaminated. BASF's responsibility for surface water and sediment contamination is undetermined. Constituents of Concern were identified through a risk screening for each Solid Waste Management Unit and Area of Concern. Constituents on the draft RCRA Persistent, Bioaccumulative and Toxic Substance List include 2-methylnaphthalene, acenaphthylene, arsenic, chromium, copper, cyanide, mercury, naphthalene, nickel, pentachlorophenol, phenanthrene and zinc.

Potential Human Exposure Pathways

Construction and maintenance workers exposed to surface and subsurface soils, and soil gases without appropriate protection.

Potential Ecological Contamination Pathways

Detroit River.

Summary of Corrective Action Activity

A groundwater extraction and treatment system is in place under a 1986 Consent Decree with the State of Michigan and USEPA. The RCRA 3008(h) Corrective Action Order requires a RFI, CMS and, if necessary, a CMI.

Control Measures Implemented

BASF has initiated a land reclamation project at the site, that included bench scale reclamation studies of AOC 4. A Report is currently being prepared for USEPA. The results of the studies were not encouraging and BASF is considering alternate reclamation technologies. The CMS is approximately 17% complete.

Facility Status Report con't:

***BASF Corp.
MID 064 197 742***

Environmental Results

In excess of 24 million gallons of contaminated ground have been pumped and treated.

Explanation of Environmental Indicators Determinations

Additional information from CMS investigation will be used to finalize Risk Assessment Exposure Determinations for soil and the control of a component of contaminated groundwater.

Monitoring Activities

Groundwater wells are being monitored for performance of the current pump and treat system.

Potential Delays in Corrective Action

Due process with any remedy selected by USEPA which BASF may dispute.

Activities Needed to Achieve CA725YE and CA750YE

BASF must confirm that a component of ground water is controlled and implement any measures deemed necessary by USEPA.

Additional Information Sources

BASF maintains a Repository at the Bacon Memorial Library , Wyandotte, Michigan

USEPA, Region 5, Waste, Pesticides and Toxics Division
RCRA Records Center, 7th Floor

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